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MALARIAL FEVERS IN THE UNITED STATES.[1]

By R. H. von Ezdorf, Surgeon, United States Public Health Service.

The investigation of the prevalence and geographic distribution of malarial fevers has been undertaken by the United States Public Health Service. To this work I was first detailed by the Surgeon General, February 28, 1912, to make a study in Alabama. On July 8, 1913, general orders were issued to include the States of Arkansas, Mississippi, South Carolina, Georgia, Florida, and later North Carolina and Tennessee.

The first step taken was to secure the available morbidity and mortality records of the States. Mortality statistics were available in only two of these States, Alabama, beginning with the year 1910, and Mississippi, beginning with November, 1912.

These have given some interesting data. For the three years, 1910, 1911, and 1912, for Alabama, the reports showed that nearly one-third (32.7 per cent) of all deaths registered as due to malarial fever occurred among children in the first decade of life, and during the first and second decades of life together, 44.6 per cent.

Taken according to sex and color, the deaths registered for white males and white females were about the same, whereas the number of colored deaths was 1.44 times greater than that of the whites, and that of colored females larger than that of colored males.

The statistics from Mississippi for the first 10 months of 1913, show that the deaths registered as due to malaria were 2.3 times as great in number among the colored as among the whites. They also showed 1 death registered in the urban districts from this cause, as against 7.1 in the rural districts, confirming the statement generally made, that malaria is mainly a rural disease.

Morbidity Data.

For the purpose of obtaining morbidity statistics and other data having a bearing on the subject of malaria, such as species of mosquitoes and their breeding places, and prophylactic measures in use, circular postal cards were mailed to physicians in the States of Alabama, Arkansas, Mississippi, Georgia, South Carolina, and Florida, calling for this information for the months of August, September, October, and November.

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[1] Read before the Southeastern Sanitary Association at its meeting held at Columbia, S. C., Feb. 12 and 13, 1914.

These have been tabulated by counties under each State and have been or will be published in reports on each State.

Only a brief summary of these may here be given to convey a general idea of the prevalence of the disease.

The months for which reports were received from each of the States and which are to be considered in this summary were for August, September, and October from Arkansas and Georgia; August, September, October, and November from South Carolina, Mississippi, and Florida; and May, June, August, September, October, and November from Alabama.

It must also be remembered that the returns from all postal cards mailed averaged about one-sixth (16.53 per cent), so that the figures here cited represent the reports of one-sixth of the physicians who received postals.

For Alabama the reports for the six months of 1913 gave a total of 12,080 cases of malaria; for Arkansas for the four months, 18,528 cases; for South Carolina for the four months, 12,000 cases; for Florida for the four months, 9,190 cases; and for the three months Georgia had 9,825 cases.

The State board of health reports for the State of Mississippi give a total of 61,811 cases for the year (January to December) 1913.

Cases were reported from every county in the States of Arkansas, Alabama, and Mississippi; all counties in South Carolina and Florida, except one in each State, from which no reports were received, and in 138 counties of the 148 in Georgia.

Seasonal prevalence.—The disease prevails throughout the year in the States of Alabama and Mississippi. No statistics of the seasonal prevalence in the other States are yet available.

It appears that the months of greatest prevalence in all these States are August and September. From all available data the disease begins to increase in the month of May, reaching its height in August, subsiding slightly in September, rapidly in October and November, and remaining about the same for the months of December to April.

The general reports and the consensus of opinion of physicians in the seven States visited are that malarial fevers prevailed to a much less extent during 1913 than in 1912. From data I have, the proportion was 1 to 3.

It would be of interest to study the meteorological reports of the Weather Bureau in a number of places in each State in this connection, in particular the relative amount of precipitation each year. For example, I found that in Mobile, Ala., the precipitation for the year 1912, which was a highly malarious year, was 89.86 inches, and for 1913, 61.42. The precipitation for 1912 for each month in the year averaged 2.32 inches more than the normal.

Types of infection.—All three types were reported in all six States, the tertian type being most prevalent. For the period of four months, August to November, 1913, in the six States, there was a total of 8,519 cases of malaria in which the diagnosis was reported confirmed microscopically. Of this number more than five-eighths (65.2 per cent) were reported to have been tertian, one-eighth (12.78 per cent) quartan and nearly one-fourth (22.02 per cent) estivo-autumnal in type. Florida and Mississippi are the only States where the quartan type was confirmed in State laboratories. I have seen but three cases of quartan malaria which originated in Alabama during my three years' service in Mobile.

It is suggested therefore that physicians using the microscope have their quartans confirmed, as many details in determining the species may be overlooked. I have had one specimen submitted to me, said to be quartan and estivo-autumnal mixed, which was, on careful examination, found to be tertian and estivo-autumnal.

Cases among children under 15 years of age.—Of 91,061 cases of malarial fever reported, 27,394 cases (30.08 per cent), nearly one-third were said to have occurred in children under 15 years of age. The percentage among the States was 28.76 per cent for Alabama, 38 per cent for Arkansas, 26.76 per cent for Florida, 26.32 per cent for Georgia, 30.05 per cent for Mississippi, and 24.39 per cent for South Carolina; the highest, therefore, being in Arkansas and the lowest in South Carolina.

Prophylactic Measures.

One or more of the following measures were reported as being in use in each State, viz: Oiling, screening, drainage, quinine, and general sanitation, but in no locality was a systematic antimalarial campaign reported to be in progress.

Mosquitoes.

Anopheles mosquitoes were said to be present in—

65 of the 79 counties in Mississippi.
46 of the 67 counties in Alabama.
40 of the 44 counties in South Carolina.
36 of the 50 counties in Florida.
51 of the 148 counties in Georgia.
63 of the 75 counties in Arkansas.

Malarial Surveys.

Surveys were made in selected localities during 1913 in the States of Arkansas, Alabama, and North Carolina, in which the topographic and climatic conditions of the locality, and social, hygienic, and economic conditions of the communities and industries were studied.

In each place visited Anopheles mosquito breeding places were found, and *Anopheles quadrimaculatus* the prevailing species. *Anopheles punctipennis* and *Anopheles crucians* were also found in these States, but to the first-mentioned species may be attributed the spread of malaria.

A malarial parasite index from blood examinations was made in five places in Arkansas, four places in Alabama, and eight places, which included a farm near Rockingham, in North Carolina.

In Arkansas there were 802 persons examined, representing about 3½ per cent of the population in the places visited, of which 53 (6.6 per cent), or about 1 in 16, showed parasite infection.

In Alabama there were 664 persons examined, of whom 25 (3.76 per cent), or about 1 in 26, showed parasite infection.

The largest number of examinations was made in North Carolina, in which State blood specimens were obtained from 3,613 persons, representing nearly 8½ per cent, or one-twelfth of the population of the places visited. There were 309 persons found to be carrying the malarial parasite, practically 1 out of every 12, equal to 8.55 per cent.

A summary report of the examinations made in each State, giving the color and types of infection found, is given in the following tables:

ALABAMA.

Place.	Examined.			Number infected.			Types.	
	White.	Colored.	Total.	White.	Colored.	Per cent.	Tertian.	Estivo-autumnal.
Anniston	131	15	146	10	2	8.22	8	4
Plateau	8	104	112		2	1.80	1	1
Leeds	209		209	4		1.91	4	
Montevallo	197		197	7		3.55	7	
	545	119	664	21	4	3.76	20	5

ARKANSAS.

Place.	Examined.			Number infected.			Types.	
	White.	Colored.	Total.	White.	Colored.	Per cent.	Tertian.	Estivo-autumnal.
Scott	15	87	[1] 102	2	7	8.80	4	5
Pine Bluff	50	56	106	5	5	9.40	7	3
Lake Village	193	130	323	9	8	5.26	14	3
Stuttgart	65	56	121	4	6	8.20	7	3
Augusta	108	42	150	5	2	4.66	3	4
	431	371	802	25	28	6.60	35	18

[1] 52 of these collected by Dr. Henry Thibault.

NORTH CAROLINA.

Place.	Examined.			Number infected.			Types.	
	White.	Colored.	Total.	White.	Colored.	Per cent.	Tertian.	Estivo-autumnal.
Elizabeth City	401	411	812	27	41	8.37	58	10
Washington	256	210	466	18	17	7.51	24	11
Rockingham	18	1	19	6	....	31.75	5	[1] 1
Edenton	368	....	368	46	....	12.50	34	12
Greenville	475	51	526	29	7	6.84	32	4
Knotts Island	515	....	[2] 515	15	....	2.91	12	3
New Bern	251	256	507	6	42	9.46	35	13
Roanoke Rapids	400	....	400	55	....	13.75	40	15
Total	2,684	929	3,613	202	107	8.552	240	69

SOUTH CAROLINA.

Place.	White.	Colored.	Total.	White.	Colored.	Per cent.	Tertian.	Estivo-autumnal.
Columbia	14	53	[3] 67	1	7	12.3	5	3

[1] Estivo-autumnal and tertian mixed.
[2] 348 of these collected by Dr. G. T. Leonard and Dr. J. D. Maynard.
[3] 30 collected by Dr. W. A. Boyd.

It will be seen that the tertian type of infection prevailed. In North Carolina, of those persons who were found to have parasites in the blood, there were 1 estivo-autumnul (22.4 per cent) to 2½; tertian (77.6 per cent); in Arkansas, 1 estivo-autumnal (34 per cent) to 2 tertian (66 per cent); in Alabama, 1 estivo-autumnal (16 per cent) to 5 tertian (84 per cent); and in Columbia, S. C., 3 estivo-autumnal (37½ per cent) to 5 tertian (62½ per cent).

A further study of the North Carolina series according to age, sex, and color, shows that of 2,164 white persons, aged 1 to 19 years, inclusive, 175 (8.08 per cent) or about 1 in 12 showed parasites, and of the 860 colored, aged 1 to 19 years, inclusive (12.21 per cent), or about 1 in 8 showed parasites. Of the persons examined who were 20 years or over of age, parasites were found in the blood of 27 whites of the 516 examined, equal to (5.23 per cent), in round numbers 1 in 20, and in 2 of 67 colored (3 per cent), or 1 in 33.

In Arkansas of 210 white persons between the ages of 1 and 19 years, inclusive, 15 (7.14 per cent), or 1 in 14, showed malarial parasites on examination, and of the 140 colored, aged 1 to 19 years, 10 were found to harbor malarial parasites, equal to (7.14 per cent) 1 in 14, which is the same rate as those of the whites at the same ages. Of those 20 years of age and over, 10 of the 221 whites (4.52 per cent), equal to about 1 in 22, and 18 of the 231 colored (7.79 per cent), equal to 1 in 12½, were found to harbor parasites.

Comparing the parasitic indices of the two States, therefore, we find that in North Carolina the percentages were higher for those under 20 years of age, whereas those in Arkansas were higher at age of 20 years and over.

The tables here given show in detail the number examined and the number of infections occurring, according to age, sex, and color.

NORTH CAROLINA.

Age in years.	Persons examined.				Number found to have malarial parasites.							
					Estivo-autumnal.				Tertian.			
	White.		Colored.		White.		Colored.		White.		Colored.	
	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.
1-3	20	22		2	1				3			
4-5	18	25	9	17					1	2	1	1
6-9	272	272	116	145	7	[1]1	2	6	17	22	15	13
10-14	509	479	163	247	14	7	6	5	42	26	15	29
15-19	192	355	54	107	3	7	1	2	13	9	2	7
20-29	90	132	25	21	1	2			6	4		1
30-39	61	69	4	10		1			3	2		
40 and over	100	64	5	2	2	1			2	2		
Not stated [2]	1	2							1		(3)	(3)
	1,263	1,420	376	551	28	19	9	13	88	67	33	51

ARKANSAS.

Age in years.	White Male.	White Female.	Colored Male.	Colored Female.	Estivo-autumnal White Male.	Estivo-autumnal White Female.	Estivo-autumnal Colored Male.	Estivo-autumnal Colored Female.	Tertian White Male.	Tertian White Female.	Tertian Colored Male.	Tertian Colored Female.
1-3	3	5	6	4				2				
4-5	8	6	3	3	1				2		1	
6-9	36	18	14	13		1			1		1	
10-14	60	23	32	15	1	1	1	1	4	1		2
15-19	43	8	29	21	1		1		2			1
20-29	69	14	59	34	1	1	1		3	1	5	
30-39	45	12	40	29	1		3	1	1	1	3	3
40 and over	72	9	51	18					1		2	
	336	95	234	137	5	3	6	4	14	3	12	6

[1] Mixed, Tertian and Estivo-autumnal. [2] History missing, 3. [3] 1 colored.

Economic aspect.—During my tours of investigation inquiries were made regarding sickness and deficiency of productive capacity of laborers employed in sawmills, on cotton plantations, etc., due to malaria. It is estimated that the average loss of time per man on account of sickness from this cause is in many places at least two weeks in the season June 1 to November 1.

Employers also increase their forces from 25 to 50 per cent during this season on account of lowered productive capacity of the employees.

Educational Propaganda.

Under the auspices of the State boards of health arrangements were made for delivering lectures to the public and to pupils at schools on the subject of malarial fevers, method of spread, and prevention. Lantern slides were sometimes used. Specimens of larvæ and pupæ were collected in the locality and demonstrated for purpose of differentiation between Anopheles and other varieties. In a few places classes of school children were taken out on a search for mosquito-breeding places and taught to identify the Anopheles larvæ.

These studies will be extended during the present year and it is hoped that the work will stimulate and excite an active interest in adopting antimalarial measures. Already there are two places in North Carolina, one, Knotts Island, under the direction of the State board of health, and another, Roanoke Rapids, under the direction of Dr. T. W. M. Long, undertaking such work, which places will undoubtedly serve as a demonstration that the disease is preventable and can be controlled, if not eliminated, when a community desires to carry out intelligent prophylactic measures based on the principle that the Anopheles mosquito is the only transmitting agent of malaria from man to man.

Letters have been sent to State health officers of Alabama, Arkansas, Florida, Georgia, Mississippi, North Carolina, South Carolina, and Tennessee, requesting them to select localities in their respective States in which they desire surveys to be made. It was stated that on the part of the United States Public Health Service surveys of localities will be undertaken to ascertain—

1. Malarial index.
2. Breeding places of Anopheles.
3. Species of Anopheles present.
4. The most practicable measures to be immediately adopted for control.
5. Educational work, by means of lectures, lantern-slide demonstrations, etc.

Acknowledgments are due to the State health officers who cooperated in furnishing statistics, in having postal cards addressed, in the collection of data and material, and in many other ways; also to all physicians who replied to the circular postal cards, and to those who furnished and assisted in the collection of materials.

THE POLLUTION OF TIDAL WATERS.

ITS BEARING ON HEALTH AND THE IMPORTANCE TO THE STATE OF ITS CONTROL.[1]

By HUGH S. CUMMING, Surgeon, United States Public Health Service.

It seems peculiarly appropriate that a subject involving the welfare of the tidal waters of Maryland should be discussed here where for years labored Prof. Brooks, who probably more than any other brought their actual and potential economic value to the attention of her citizens.

I have been honored by the request to discuss the subject, "The bearing of pollution of tidal waters on health and the importance to the State of the control of such pollution."

Not many years have passed since communities, as a matter of course, discharged their pollution untreated into the nearest stream

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[1] Read before the Maryland Conservation Association at its first annual meeting, Baltimore, Md., Feb. 25, 1914.